

**Banana Cultivation
and
Handling Practices in the
Chapare**

BY: ROBERT MALONEY

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Contact: Steve Huffstutlar, Chief of Party

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Edificio Los Tiempos Piso 7
Telf. 252096, 251655, 257827, 530278, 530149 Fax. 232773
Cochabamba, Bolivia

EXECUTIVE SUMMARY

Bananas produced in the Chapare have the potential to compete with the bananas in any regional market. If export to the U.S. and Europe were feasible, the quality could potentially compete in those markets.

Bananas have the potential to compete as demonstrated by the quality of production of some of the farms in the region. If this potential is to be realized, the production capability of all farms that would participate in export must be brought to a uniform level of efficient, quality production.

Beyond the ability to produce or compete, there are more fundamental questions that must be answered. How will the volume of bananas that exist in the Chapare now and in the near future be marketed? Is the increase of production or marketable yields a sensible goal if the bananas cannot be sold?

Based on observations on farms, and conversations with association members and others in the region, recommendations are offered to assist the farmers of the region to achieve their potential. Not all farmers are going to be exporters. As with any industry some will not take part, but for all those who will make the effort, these recommendations for activities are made to the CONCADE project:

- 1) Develop and implement a program of training and demonstration to ensure that there is a uniformity of quality production throughout the Chapare region. This would include encouraging each association to have its own well-trained technician.
- 2) Through an ONG, develop an extension program that would serve to monitor activities on the farm and offer advice the organization and quality of activities when necessary. The extensionists would also serve as a link between the associations and IBTA and other research organizations and provide follow-up when outside services have been requested
- 3) Conduct a market analysis to determine what volumes, forms and quality levels of bananas are required for the regional export markets. Develop relationships with distributors to cooperate in the introduction of new forms of consumer and institutional packs. Develop realistic price projections for bananas that allow cost/benefit and other economic analyses to be made by the farmers and the exporters.
- 4) Develop and implement a program of quality assurance to ensure reliable volumes of bananas of acceptable market quality. Initiate a program using quality control data from boxed banana, waste banana, and market inspections as a tool for reducing losses and optimizing production.
- 5) Initiate direct contact with FHIA for advice on the continued introduction of black sigatoka cultivars to the region. Develop a program to ensure pure propagation material is obtained and properly managed.

The response of the farmers to the question, "What do you need most to help you produce well?" was invariably, "Reliable and timely help with my field problems."

One of the most notable changes in the attitude of the farmers since this author was in Bolivia in 1992, is the attitude that with increased income from export sales they need little help from development projects. The assistance need that was mentioned was for more infrastructure such as cableways so they could participate in exportation.

Today, there are many players in the developing banana industry. There are farmers, research personnel, exporters, chiperos, farm service representatives and Project personnel all of whom are interdependent. Representatives from all these entities should form an informal committee to keep one another aware of problems and ideas that affect the industry.

There is no doubting the potential of bananas in the Chapare as an industry. This report offers some recommendations to help farmers realize that potential.

SECTION I

OBSERVATIONS ON AREAS AND FARMS VISITED

During the days from 30 November to Friday, December 3, I visited the principal banana production areas and associations in the Chapare, accompanied by Rolando Escobar of IBTA/Chapare. On Saturday, 4 December I visited a packing operation of BANABOL and on Monday, 6 December a visit was made to Ingavi B with a technician from Andean Group. Tuesday, 7 December I visited the operations of Chapare Export and General Roman accompanied by consulting entomologists. On 8 December a return visit was made to Chapare Export to visit the packing operation. The following is a brief description of the observations made in each area. In a later section of this report there is more detailed discussion of the cultural practices and conditions based on observations throughout the region.

Tuesday, 30 November:

The day was spent at the IBTA/Chapare Research Station, La Jota and in the areas of San Luis and Villa Fernandez.

The La Jota research station has a plant re-production capability of 150,000 (?) plants per year using tissue culture and rapid reproduction methods. Given the present quality of production on many of the farms, much of the increase of acreage should be possible in large part by the development within the various associations of areas dedicated to the production of suckers for transplant.

The potential of some of the FHIA varieties (FHIAs 1, 18 and 23 especially) demonstrates the need to further investigate in both the farm and the market which of the varieties should be propagated. The capabilities of IBTA/Chapare should be used to create the planting material when the decision on varieties has been made. The plants will be less expensive if produced by IBTA. If IBTA can obtain the genetic material directly from FHIA there will be less confusion about which varieties they actually have and less contamination or mix of varieties as was seen in some demonstration plots.

The soils in La Jota are not suitable for banana production, but the plantings there demonstrate the ability of most of the varieties that have been introduced to produce well.

One condition noted on the station was the large number of doubled or fallen plants. The unusual dry spell that has occurred recently has caused the plants to lose turgidity. The Gran Nain, Valery and Williams varieties (cultivars) can barely support a large stem of bananas under normal conditions. In windy areas, or in the case of dry weather causing a loss of turgidity in the pseudostem, the grower should use props on the plants to ensure that the stem is not lost due to the doubling of the plant.

On the station the first sunburning of the fingers was seen. This condition is a result of the use of clear plastic bags. The condition did not exist on any stems covered by the light blue nearly opaque bags.

In the afternoon we visited San Luis. There we met with Leonardo Jaillita of the local banana association. This association currently has two blocks of bananas in good production with a total of 90 hectares and the potential for 80 hectares more. In this association the growers have a "division of labor" in which certain

farmers are assigned tasks such as protection of the stems, pruning of suckers, de-leafing, spraying, etc., that enable them to properly maintain a greater area than one grower can manage doing all the tasks himself. There is more discussion about this in a later section of this report.

The production in this area has suffered due to recent flooding, but the production practices of the growers need to be improved. Most noticeable was the poor pruning of suckers with the result of poor plant spacing and uneven ratooning.

During our visit with Sr. Jaillita there was a *chipa* buyer present. This gentleman buys bananas and takes them to Villazon where he has a rustic facility for holding the bananas prior to their sale to Argentines. He expressed an interest in how to keep the bananas in good condition in cold weather and was very interested in how he could ripen the bananas according to some schedule.

This is the first time that I have had the opportunity to speak with a *chipero* and found his problems to be of interest and their resolution a probable benefit to the growers. While it is very difficult to provide technical assistance to a group like this, an effort should be made to see if there are any common problems with which they can be helped.

All the bananas of this association are sold in chipas, mostly washed chipas from stems that have been protected by bagging.

In Villa Fernandez we met with some members of ASPROBACI. This association has 100 hectares in blocks for aerial, cableways and a packing shed. They have a contract with Andean Group and receive bags from them, but do not deliver fruit because of the lack of reefer trailers.

The association members admit that they are controlling production poorly and need better organization in the field. They feel they need their own technician to be there full time and also understand the potential benefits of a division of labor on the associations farms.

In this area IBTA has an experimental/observation block of FHIA 1 and 18 cultivars. Within the block there are plants which are off-types due to either a mistake when the order was put together for shipment to IBTA or contamination in the fields of origin.

Also in this area is a block of bananas where the incidence of black sigatoka spotting is observed and fumigation carried out only when the incidence of infection warrants it. Ordinarily, the spraying is done every 10 days. By monitoring the amount of infection it is possible to maintain the same control every 18-20 days. This greatly reduces the costs of black sigatoka control. This difference in number of days between applications of fungicides will probably be less in the rainier time of the year than in current times.

Wednesday, 1 December:

The day was spent visiting Villa San Roman and San Carlos.

The first grower visited was Fortunato Arnez. This grower has 5 hectares of very good production. His farm is located about one kilometer from the packing shed on the farm of Oscar Zavala, but without cableways cannot pack his bananas if, or when, export takes place. He currently sells his bananas by the chipa and receives B65./chipa. This is the best price that we found anyone to be receiving. The price received per chipa basically depends on four factors:

1. The hands are washed (cleaned and treated with alum and Benlate) or not washed. The washed fruit bringing a higher price.
2. In conjunction with washing, fruit that has been bagged brings a higher price.

3. Ease of accessibility for the buyer increases price. The farther off the main road the buyer has to drive, the less he pays.

4. The presence of competition or lack of it, greatly influences price. In one area the price is as low as B30./chipa due to the distance of the farms from the main road and lack of competition.

Also in this area we visited the farm of Oscar Zavala. Sr. Zavala has 15 ha and expects increase soon to 30 ha. There is a packing shed on his farm and some cableways. This is the packing shed that would be used by his neighbor, Fortunato Arnez if he could get his bananas there by cable. It needs to be noted that the quality of production of Sr. Arnez is superior to that of Sr. Zavala.

One problem that Sr. Zavala has in his farm appears to be herbicide damage. He knows that Roundup was used in the affected area and that some mistakes were made. The plants are weak, have a slime at their bases and the leaves are discolored. By reasonable deduction, it appears the problem is due to the use of Roundup. The plants should grow out of the problem in the next generation.

The use of Roundup should be discouraged except in case where there is no effect by other broadleaf herbicides.

In San Carlos we visited the demonstration plots of IBTA/Chapare. These are well maintained plots and growers have said that the plots are useful to them in helping to understand the cultivation practices and see the results of these practices. However, when the farmer alongside the demonstration plot has a noticeably poorer field, one realizes that it takes more than demonstration for some farmers.

In San Carlos we met with Sr. Leon Montaña, president of the association. The association members have a total of 100 hectares currently in production and have up to 100 hectares more that are possible.

This association, as with all that were visited, has a contract with Andean Group. Most of the farmers are maintaining good cultivation practices and they are depending upon Andean Group to buy their production.

The association is asking for technical assistance, especially for the control of sigatoka.

Thursday, 2 December:

The day was spent visiting production areas in Sub-region VII.

In Ivirgarzama we met with Guinter Marcos of IBTA/MIP and went with him to the field. The first stop was at the demonstration plot being maintained by IBTA. This plot is well maintained and from the condition of farms in the area it appears that farmers are using the cultivation practices demonstrated there.

This is a new region for banana production and the need for technical assistance is greater due to the large number of new farmers.

The region is drier than the older production areas nearer the mountains and the soils are poorer. In spite of the poor soils, production is very good on some farms and the region definitely has the potential to efficiently produce quality bananas.

With Guinter Marcos, we went to the farm of Alberto Lauro of the 16 de julio association. This group has 25 members with a total of 100 hectares in production with cableways and expect to increase the hectareage to 190 ha.

The growers say they need technical assistance, but their principal concern is that they will not be able to participate in export production because they are not maintaining their farms. They blame the failure to maintain there farms on the failure of Andean Group to export.

The growers are correct to certain point. The additional income derived from export production and sales is needed to pay for costs of production inputs. Another factor that influences the lack of inputs is the low price received by many growers for their chipas. While a washed chipa in some areas may sell for as much as B65. and the average is about B50., the growers in this association, well off the highway, receive only B30. per chipa.

In spite of their claim of not being able to properly maintain their farms, most of the production is in good condition or lacks little to be in good condition. The size and quality of the stems is as good or better than farms in other regions. In Chiboco we met with Felix Olmos, president of AIPAI. AIPAI has 50 hectares of good production and expect to have 120 hectares. Sr. Olmos has 16 hectares of production that are the best that I saw in my visit to this time. The farm is planted at a spacing of 2.6 m hexagonally and the *deshije* is correctly managed. In general, the farms visited in all areas had plant populations that are too low. In some areas the farmers are leaving doubles. This increases population, but negatively affects the plant spacing.

This association packs export fruit for BANABOL when they are lacking sufficient bananas to meet their marketing needs. Fruit packing was scheduled on this farm for 4 December. The packing operation is reported in a later section.

In the same region we met with Berno Zuita of the Urkupiña association. This association has 28 members and a total of 30 hectares of production. These farmers have newly planted lands. Since they are new to the production of bananas it should be easier to instill good production habits in these growers than it has been with those who have several years of experience with traditional varieties.

Friday, 4 December:

On this day we visited with grower/members of ASPROBAN in Senda B. This is one of the oldest banana associations and one of the first to participate in the exportation of bananas. There are 25 members with about 100 hectares of production. The number of members has gone down from 100. The association members with whom we spoke claim that this loss of members is due, in part, to the costs of production.

This association has its own technician that monitors the production operations and reports problems to IBTA. In spite of having a technician, the fields show a lack of failure to complete simple tasks such as the removal of dead or doubled leaves, timely bagging of the stems, etc.

Some farmers appear to have planted more hectareage than they are able to handle. In commercial banana production in other countries, it is considered that one worker is needed for every 4 hectares. This ratio of worker to hectare is based upon the worker being assigned on task in which he specializes and for which he is responsible.

In this association each member hires one man to work as part of a crew. A work plan is drawn up and workers assigned specific tasks. Each week a different member of the association is in charge of the work crew.

A system such as this would be ideal for the maintenance of good production, but it is not a system without faults. In spite of their efforts the cultivation practices and the conditions on the farms are not as timely and well managed as they should be.

Saturday, 4 December:

A visit was made to BANABOL. There was no one at the farm as fruit was being packed at the farm of Sr. Felix Olmos.

A brief visit was made to the fields and it was observed that the production on this farm is the poorest seen in the Chapare region in spite of the fact that they do have reasonably good cultivation management practices. The stems that are hanging in the field are small and appear to have more finger curve than is found on other farms.

There is drainage on the farms, but given the dryness of the area this may be detrimental. This is what local technicians think, but the poor production is most likely due to poor soils and plant spacing that is too open.

The bagging of stems is not up to date. Some stems have been left unbagged, probably due to the practice of not bagging those stems that do not meet the minimum number of hands to be cost effectively bagged.

There is a variety of bags being used. Some of the bags appear to be of high-density polyethylene. The region is more windy than other parts of the Chapare and bags are torn. The bags that seem to be high-density polyethylene have the greatest incidence of tearing. In a windy area a torn bag can cause severe scarring on the fruit.

We were told that the packing that day was on the farm of Felix Olmos in Chinboco.

We went to the farm and were told that they were packing 850 cartons of bananas for BANABOL. The packing operation was carried out by BANABOL personnel.

The following are observations of the packing operation:

The bananas stems are brought to the packing shed by a cableway. There is no area at the shed for the accumulation of stems and there is no shade for the stems as they hang prior to de-handing.

The lack of shade is no problem as long as the stems are not left to hang in the sun. Bananas will burn if they are motionless in the sun. It is a good practice to bring several stems of bananas to the packing shed prior to the beginning of the packing operations.

This allows for marking of hands for special packs or for discard. It also ensures that there are stems available for packing in case of delays on the farm that might interrupt packing operations. Down time due to lack of stems to process can seriously reduce the efficiency of a packing operation. Also, it allows the de-latexing tank to be filled prior to beginning the packing. In order to ensure the hands remain a sufficiently long time in the water to allow the latex flow to stop, the tank should always be full.

The following observations were made in the packing operation:

Only 8-10 stems are brought to the packing shed at a time since there is no place to hold the stems. The stems are de-handled, clusters made and the clusters moved quickly through the de-latexing tank to the packers.

De-latexing is the process of allowing the latex to flow from the cut crown surfaces into the water of the tank. When bananas are harvested at their correct maturity this flow continues for as long as 15 minutes. The length of the de-latexing tank was originally determined and designed to allow the bananas to spend sufficient time in the water to stop the flow of latex. The tank should be full of clusters at all times and the rate of removal of clusters should be the same as the rate of placement of clusters into the tank.

Alum is applied to the clusters to prevent the oxidation and discoloration of the latex that might exude from the crowns after packing that results in the defect known as latex stain. If the de-latexing time has no been adequate and the flow continues after packing, the alum often is not enough to prevent staining. Also, the flow of latex is often serious enough to remove the Benlate or other fungicide that has been applied and crown rot can occur.

When the hands are being cut into clusters there is no removal of defective fingers unless they affect the ability of the cluster. Some clusters are severely scarred, but the overall cosmetic quality is good.

The crowns of the clusters are cleanly cut, apparently with well-sharpened knives. This is very important. If crown rot is a problem the edges of the crowns should be beveled to reduce the sharp edges that can damage other clusters during the packing operation or can be crushed, exposing the broken tissues to the introduction of crown rot fungi.

There is no water at the packing shed. Normally the water in the de-latexing tank is sprayed under pressure toward the packing end of the tank. This impulse of water pushes the clusters from the de-handing end of the tank to the packers. It also keeps the crowns of the clusters that remain above water wet enough to remove latex flowing from the cut crown surfaces.

In this packing shed the women throw the clusters into the de-latexing tank. Since there is no flow of water to move the clusters, they fall on top of other clusters causing damage to either or both clusters. The women should pass the clusters gently into the tank to avoid this problem.

It would also be helpful to pad the edge of the tank where the clusters enter so they do not rub against the sharp edge of the tank wall. This can be done with pieces of pseudostem cut lengthwise or, preferably with foam rubber covered with plastic.

A person at one or both sides of the tank with a long padded stick could gently and slowly move the clusters to the packers. Most of the clusters in the tank are moved by a pole and are moved too quickly. The flow of latex must be nearly stopped.

Due mainly to the restricted amount of space in the packing area, the clusters were placed one atop the other on the trays. This resulted in excessive handling of the clusters by the packer when trying to find a cluster of proper size for the packing space. A knapsack sprayer was used to apply alum and Benlate. The application was not complete since some clusters covered others and blocked the spray.

The pack is supposed to be 22.5 k or 50 lb. The boxes are being packed in a carton that may be a little small for this amount of fruit. The fruit is being packed in five lines instead of the four lines normally used for an 18.5 k or 41 lb. pack. When a carton of fruit is correctly packed the carton top and bottom should be flush. If any clusters are packed so that they are above the top edge of the carton the result will be serious damage to those and other clusters in the carton. The carton itself should support the weight of the cartons above it, not the bananas. The tops on the packed boxes were all 1 - 2 inches above the top edge of the box bottom.

This over-pack results in serious bruising, scarring and may open the crown tissue to infection and crown rot. Moreover, these boxes had to contain at least 55 lb. of bananas and most were probably closer to 60 lb. There was no scale available in the shed to verify the weights, but Sr. Olmos and others were probably losing 10 to 20% of their fruit.

It has been a common practice in the past for the growers in some countries to pack extra weight to make up for poor quality. This practice is not appreciated by the markets. In this case, the good quality of the bananas was being reduced and nothing was gained by anyone.

Cooling of bananas is critical. No market wants to receive ripe and turning bananas. The ability of a cooling system to cool a box of bananas is dependent upon the cooled air being able to reach the surface of the bananas. A box of bananas, with the plastic bag or sheet and the liner board inside the carton, is very difficult to cool. The ventilation holes must be clear and the cartons stacked to permit the air to move through the cartons as freely as possible.

The imported cartons being used have ventilation holes that do not align and some die cuts that are not removed. This is a very serious defect and should not be tolerated. In addition to the holes that do not align,

The fact that the top of the carton does not completely align with the bottom further aggravates this condition.

Some cartons produced in Santa Cruz were being tested during this fruit cut. Almost none of the die cuts were removed. Usually when die cuts are not removed they can be easily pulled out by hand. Many of the die cuts in these boxes were not fully cut and removing them resulted in tearing the boxes.

Management should never have allowed these cartons to be used for packing bananas. This entire operation was sloppy. I doubt that the top management would allow these errors to occur. Somewhere their system has broken down and should be reviewed before they incur serious quality and marketing problems.

Monday, 6 December:

In Chimoré we met with Roberto Cayo, technician for Andean Group and went to the offices of Ingavi B.

This association has been packing bananas for Andean Group who export to the market in Córdoba, Argentina. In the past 2-3 months the association has packed 10,000 cartons of bananas for Andean Group.

The association has 4 blocks that total 220 hectares. The association has 6 blocks in process and feel that they can eventually have 1000 hectares total area in blocks.

Roberto Cayo, brother of the Andean Group technician is the technician for Ingavi B. He met with us and took us the field and to two of the three packing sheds the association has. Each block has its own packing shed. The fourth block has a packing shed that has yet to be finished.

The association is considered to be the best overall producer of bananas. Most of the farms are well maintained, but Roberto Cayo told us that they were having problems bringing all farms to a uniform, good quality level.

In this association each farmer maintains his own farm. As was mentioned previously, this is a difficult task for some regardless of the size of their farm and difficult for anyone when the hectareage is greater than the ability of the labor to complete all the necessary tasks in a timely manner.

Most of the sigatoka control in this area has been by ground spray with cycles every 14-15 days. A contract has been made with an aerial spray firm and the cycle will be every 20 days.

They do not have a program of monitoring the incidence of sigatoka lesions, but plan to implement one. They expect that this will probably reduce the number of sprayings, especially in the drier times of the year.

Andean Group has quality standards for the boxed bananas. Based on those standards the association has had losses of about 25% due mainly to handling damage. They recognize the problem and would like assistance in reducing these losses.

Andean Group, unlike BANABOL has a specification of 8" over the curve of the banana for a minimum length. As was mentioned previously, this is costly. I do not believe that this length is necessary. Eight inches is the length required for the U.S. and European markets. I believe that a market study would show that neither the Argentinean nor the Chilean markets require this length.

While it is necessary to be better than your competition, there are limits as to how much better you need to be and how much you should pay to achieve superiority. What seems to me to be over-kill is very costly to the grower.

The area of the association does not have electricity and probably will not have for the next 8-10 months. As in the case of the farm of Sr. Felix Olmos, the packing sheds have no running water for filling tanks or moving fruit through the de-latexing tank.

Additionally, it was pointed out that the packing sheds lack some essential equipment such as, knives, rollers, trays, scales, etc. If quality processing and good handling are to occur, the necessary equipment must somehow be made available.

The first packing shed we visited is the oldest one and has no area for holding cut stems prior to processing. Other infrastructural problems were the same as those found on the farm of Sr. Olmos and some suggestions were made on how to alleviate some problems.

The second packing shed is the newest and while it has many of the problems of the other shed, it does have a place to hold stems. They are also completing an upper area for the construction of boxes.

During a visit last week by the consultant from Costa Rica, they were told that the carton being used for the 22.5 kilo pack is the one used elsewhere for the 18.5 kilo pack. As I mentioned before, I have the same feeling. I would have to check the specifications manual I have in my office to confirm this and will when I return. I will send a copy of the specifications to George Wilson when I return home.

Another specification that needs to be checked is that of the plastic slip sheet used in packing. I think this sheet is about one-third thicker than necessary. The holes in the sheet are definitely spaced too far apart. The holes should be .5 inches in diameter and spaced 3 inches apart. The holes in the slipsheets or polytubes being used are 4 inches apart. The spacing of the holes is crucial for adequate cooling.

The cartons used by Andean Group come with some ventilation holes blocked by die cuts that were not removed in fabrication. This is normal and in the packing shed there is a person who removes any that remain prior to packing.

On the farm I was shown a disease problem that has affected plants in certain areas. The problem causes rotting in the pseudostem, bunching of leaves, lesions on the mid rib and if the plant produces a stem it is very small.

A technician from IBTA/Chapare took a sample of the material from the farm about a year ago, but the association has heard nothing about the results of any tests nor has had any further communication from IBTA.

They also say that tests and experiments have been run on association farms and they have not been given any reports from these experiments.

IBTA/Chapare needs to play an important role in the continued development of the banana industry in the region and it is critical that they respond to the needs of the growers.

From the description of the problem, especially that the plants had a very bad smell it sounds like the infection was what is called rhizome rot caused by one of the bacteria *erwinia*. If this is the problem, it is one caused by the plant being in conditions that are too moist. It is a disease that may be propagated by machete, but otherwise is not contagious.

From the farms we went to the *centro de acopio*, La Jota. The boxed bananas are brought to the cooling room here and cooled in about 24 hours to 14-15°C.

The boxes are packed better than the boxes seen at the packing operation of BANABOL. Fewer boxes were over-packed.

An effort should be made to palletize the boxed bananas in the reefer trailer at the packing shed so the handling in the cooling room is minimized.

Andean Group has no reefer trailers and are renting for current use. This company has contracts with all of the associations visited and provides materials to some of them. It is hoped that the contracts with the

growers have not raised their hopes too much for it may be awhile before the company is able to buy from all the associations.

Equally important, it is likely that the company may try to force the project into some means of providing reefer units, using the expectations of the growers as a bargaining tool.

Tuesday, 7 December:

Met with Pastor Zambrana at the Chapare Export farm, Juan Pablo II. This is one of five farms that the company has and part of 180 hectares total production.

The farm is planted in Guayaquil (Valery), Gran Nain and Williams. The preferred cultivar is Guayaquil. The production is good, but stem size is ordinary compared to other farms in the Chapare.

One practice noticed is the use of Roundup herbicide in established plantations. Although Roundup is a contact herbicide and there is supposedly no residual effect, it seems a very dangerous practice to use this herbicide. The assumed bad effects of misuse of this herbicide was noticed on the farm of Sr. Zavala in General Roman.

The company had some fruit waiting to be shipped. Among the boxes were several boxes of "single-finger pack." The size of the fruit far exceeds the usual size of fingers desired by the market. This is a misuse of the pack. This pack is discussed further in a later section.

The company has about 15 reefer trailers and has been shipping 5000 boxes per week. This looks good for numbers on exports from the Chapare, but does little good for small farmers.

Control of sigatoka is very good on these farms. Sr. Zambrana said his cycles were every 25 days in the rainy season and every 40 days in the dry season. This the best control heard of in the region and if it is correct someone should look very closely at what they are doing to achieve this.

The matter of the extensionists from IBTA/Chapare came up and the same opinion expressed that the extensionists serve no purpose for the growers. What Sr. Zambrana and his technicians agreed on was the need for a responsive technical service, especially for pathological and physiological problem-solving.

Wednesday, 8 December:

Returned to the packing shed of Chapare Export where fruit was being packed for export to Argentina. This fruit is cleaner and better packed than that of BANABOL. The quality is not good, but it meets the requirements of the market.

The Argentinean market wants weight in the box, according to the Ecuadorian technician employed by Chapare Export. This is undoubtedly correct and an effort needs to be made in the market to find someone who will handle good quality fruit packed in weights appropriate for the carton size.

The consumer anywhere appreciates quality, which in bananas, as in most products means an absence of cosmetic defects. If the problems caused by poor quality were only cosmetic one might argue that it was silly to worry about defects. Defects do cause problems of losses as well as detracting from the appearance of the fruit. So long as consumers will pay more for a pretty product, the one who supplies the prettiest fruit will capture the market.

SECTION II

COMMENTS ON BANANA CULTIVATION AND HANDLING PRACTICES IN THE CHAPARE

This section is a discussion of the observations related to the cultivation, farm management, and banana handling practices from planting to the market. Time did not allow for an intensive study of any one area and these comments are to be considered as general in nature. Not all of the comments are representative of all farms, but the practices discussed do apply to all farms.

The basic premise of this section is that all growers would like to participate in production for export and that with effort most of them can. The level of effort and the amount of success they have depends upon their ability to deal with the following production factors:

SOILS

Drainage is not good in the Chapare, especially in the areas of highest rainfall. This is a limiting factor in production, but not one that eliminates growers without drainage from profitably being part of an export production operation.

In properly maintained farms throughout the Chapare the quality of the stems is good. A few farms have what appear to be symptoms of nitrogen deficiencies. Potassium deficiencies exist and are generally found on poorly maintained farms. (There may be a cause and effect relationship here). Farmers in the area of Sajta, where soils are known to be poor, claim that they need potassium to get increased finger length. This may be true, but is undoubtedly only part of their problem since neighboring farms have good finger length.

IBTA/Chapare has made fertilizer trials and has recommended amounts of N and K to be applied on farms in the Chapare. It would be beneficial to run trials on existing commercial farms would be useful to determine the costs and benefits of various fertilizer applications with regard to fruit quality factors such as finger length.

When the lack of drainage is severe it is usual to see rhizome rot and rhizomes that have been pushed from the soil by hydrostatic pressure. None of this was seen or mentioned during my visits to the production areas.

Some farms (such as near the ASPROBAN packing shed) have potential for a certain amount of drainage to creeks or low-lying unplanted areas. In the wetter parts of the Chapare any small amount of drainage of standing water left after a rain would be helpful.

WEED CONTROL

There are two schools of thought on the amount of ground cover there should be in a banana plantation. One is to have bare ground, completely free of weeds, the other is to maintain some type of ground cover.

The proponents of ground cover point to the possibility of soil compaction resulting from rain falling on the bare ground and an erosion of the soil in areas of heavy rainfall.

Neither of these factors seems to be valid and most farm managers prefer to maintain the farm free of any weeds. Weeds are hosts to banana diseases and insects. As an example, one of the primary hosts of moko can be found in the banana farms, but fortunately, moko does not exist.

Studies have been done in the past on leguminous ground covers. These are beneficial as they not only fix nitrogen, they also dominate weeds that would otherwise grow and have to be removed. The problem with many ground covers is that they are vines and climb plants and cover the daughter plants, retarding their growth. Research was done on this in the 1970's by Dr. D. Richardson of the United Fruit Company. Information on the results may still exist in FHIA.

In general, weed control is good. Some farms are excellent, others are poor. Although only one of the many factors related to good production, nonetheless, the best farms also have the best weed control. Obviously, in conditions of low soil nutrients, the banana plant does not need competition from weeds.

Weed control, when combined with the other tasks on the farm is a time-consuming operation. Most farmers who are well organized and have paid laborers or those who have "divisions of labor" among the members of their associations manage to control weeds.

Except, perhaps, when a farm is first being established, the use of herbicides, especially Roundup, as mentioned previously, should be discouraged. In a new planting it is critical that the young plants are allowed to grow without the competition from weeds.

For those few instances when herbicides are necessary their use should be under the advice and supervision of technicians from IBTA/Chapare.

PLANT POPULATIONS

In general, the plant populations of the farms in the Chapare appear to be too low. Most of the farms visited had the plants spaced at 3 meters. Most of these farms had the plants spaced hexagonally, others were planted in squares. Little can be done without careful attention and assistance from a skilled technician to close the spacing on an established plantation so many farmers will have to live with the condition.

Each farm has a population it can support and new plantings should be made with the assistance of a technician who can judge the performance of the existing population and recommend a change in spacing, if necessary. In most areas I feel that a hexagonal spacing of 2.7 or 2.8 meters would be best. The farm of Felix Olmos in Chinboco supports the recommendation of close plant spacing in poorer soils. His farm is planted at 2.6 meters and production is excellent.

One argument against reduced spacings is the increased difficulty in sigatoka control. From what I have seen, this is not a significant factor.

PRUNING OF SUCKERS (DESHIJADO)

The most important, difficult and least well-managed task on the banana farms in the Chapare is the pruning of suckers or *deshijado*. Sustainable production is dependent upon the correct selection of daughter plants to be left for the following generation and the careful removal of unwanted ones.

The selection of vigorous daughter plants (*hijos de espada*) has the following benefits:

- Maximization of production to guarantee the most income per hectare per year possible over a period of several years..
- Good sized stems yielding a good conversion stems to boxes.

- Maintenance of the correct population within the farm relative to the soil type or types found on the farm.
- Avoidance of competition between plants for nutrients, light and water.
- Reduction of damage to the hanging stems by leaves of the daughter plant or a neighboring plant.

Proper maintenance of the deshijado is the most important factor in the assuring continuous good production over the long-term.

The introduction of cableways has added a new dimension to the deshijado. The selection of the hijo to be left for production must not be left on the side of the cableway. When a stem does shoot on the cableway side of the plant it should be guyed away from the cableway so as not to be hit and damaged by stems being moved on the cableway.

A problem seen on several farms that is related not only to deshijado, but also to other operations requiring the use of a machete, is that of damage to plants by the machete. Farmers should be made aware of the infections or weakening of plants caused by carelessness and trained in the proper way to remove hijos or do other tasks with the machete.

DE-LEAFING (DESHOJADO)

There are two types of leaf removal (*deshoje*) and each has a different purpose.

The removal of leaves with sigatoka lesions is necessary to maintain the farm in a sanitary condition and eliminate the leaf as a source of contamination.

The other deshoje is the removal of leaves that are doubled or that are touching the stem of the same or another plant.

At the time the stem of fruit is bagged the sheath known as the *capote* should be pulled back between the leaves so it does not hang over the stem. Any other leaves that touch the stem should also be removed. The maturing stems should be checked occasionally to be certain that no leaves of the same or neighboring plant have grown and touch the stem.

In addition to leaves that can damage stems, there are those doubled leaves that can do serious damage to the hijo(s). Doubled leaves that are infected with sigatoka and double over the hijo can deposit spores on the hijo and ruin its vigor. Leaves that are infected or not infected, when doubled over the hijo cut off the light that the hijo need for growth.

Too many farms do not have good leaf removal. This is not a practice that requires skill. For whatever reason that this task is not carried out well on all farms, the growers have to be encouraged to implement better management of this task.

BAGGING OF STEMS (EMBOLSADO)

On most farms the bagging of stems is carried out in a timely manner.

At the time of bagging the stem the bud (*bellota*), all false hands, (those with male flowers), and one or more true hands are removed. The number of true hands removed depends upon the number of hands on the stem and the variety. In the Gran Nain and Valery cultivars the method is to remove one hand from a stem of eight hand or less and two from stems with nine hands or more. Of the upper hand(s) removed, one or two fingers should be left to prevent rot to reach the hands of the stem.

The reason for the removal of hands is based on research done in the United Fruit Company to ensure the maximum production of fingers meeting the Chiquita specifications of a minimum of 8 inches over the curve of the finger and minimum finger diameter (grade-specified at time of fruit packing). It was determined that 70% of the weight lost in de-handing was recuperated by the additional nutrients that went to the remaining hands.

The specifications of BANABOL include a minimum finger length of 7.5 inches. It is probable that the elimination of two hands on the larger stems is not economical. Possibly, (but less likely) the removal of one hand from smaller stems is also uneconomical. This practice needs to be studied to determine its cost effectiveness.

AGE AND GRADE CONTROL

To maximize production of banana production and reduce the amount of ripe and turning fruit at destination, a system of control of age and grade has been implemented.

Each week when the stems of that week are bagged a ribbon of a specified color is attached to the top of the bag. Based on historical growth and temperature data in the Chapare, the stems are cut over a period of three weeks starting in week 12 unless cool weather requires a delay. In any one week stems with three different colored ribbons are cut. One color ribbon is cut for the first time if it meets the grade size on the center finger of the sub-basal hand (the highest hand on the side away from the pseudostem, usually the second highest hand). Stems with another color ribbon are also cut for the second week if the fingers meet the grade requirement. Stems with the third color, in their third week of cut are cut regardless of their grade and only the ends meeting the required grade are packed. This reduces the incidence of ripe and turning fruit at the port of destination.

This system is very important to ensure maximum yields from the farms, but is really only useful if there are continuous fruit cuts for export. Currently the system is employed at bagging, but fruit is left in the field until nearly ripe. When exportation is seriously functioning, the weight of stems will be noticeably lower.

The age grade control program is not as simple as it sounds. This system depends on the stems being bagged and marked in a timely fashion. If bagging is done once a week, Monday for instance, stems that appeared and were not ready the previous Monday should be bagged and marked with the previous week's color. If this is not done there can be a difference as great as 12 days of age among the stems of any one color. In warmer weather especially, this can seriously affect the usefulness of the system.

It is important that all farmers understand the need for timely bagging and marking of stems and complete the task accordingly.

SIGATOKA CONTROL

The most costly and necessary task in the banana farms of the Chapare is the control of black sigatoka. Much has been written by experts about the problem, but I'll include a few notes of my own.

Black sigatoka can be effectively controlled in the Chapare. The best control is by aerial spray of blocks. In spite of what some naysayers predicted, the sigatoka can also be effectively controlled by motorized knapsack sprayers by workers on foot. In most areas the control by ground spraying is as effective as that of aerial spraying. The principal benefit that aerial spraying has over knapsack spraying is that the new, young leaves receive better coverage from aerial spray. These leaves must be kept clean if the plant is to survive. Careful monitoring of infections can make a combination of de-leafing, ground spray and aerial spraying effective and less costly than a spray program determined by a calendar.

IBTA/Chapare has some plots where the sigatoka spraying is done when the condition of the leaves warrants it instead of on a fixed schedule. In Villa Fernandez the monitoring program in the IBTA plots has

reduced the application time from every 10 days to every 18-20 days. This greatly reduces the cost to the farmer and is a system that should be further tested.

Farmers could also help themselves reduce the incidence of black sigatoka by doing a better job of removing infected leaves from the plants more frequently.

A major problem with black sigatoka is the amount of hectareage that has no control. This uncontrolled sigatoka is a constant source of contamination for those who are making an effort to keep their farms clean. Hopefully, in the future when the associations are exporting and are better organized they will bring pressure on growers to control the sigatoka or destroy the infected plantations.

HECTARAGE AND MARKETING:

The hectareage of bananas of the varieties other than Mogotaki constitute about 1000 acres in the region. These varieties, (Gran Nain, Williams, Valery or Guayaquil) are those that provide bananas for export. The Mogotaki does not have the yield or quality potential of these other varieties.

All of the associations with whom we visited have plans to expand their hectareage or are doing so. Many of the hectares are not well managed, but could be quickly brought to export quality if needed.

The CORDEP/DAI, Guía Informativa: BANANO, PIÑA, PALMITO, MARACUYA, PIMIENTA, April 1999, states that, "In general, up to 2000 boxes/ha/yr can be expected..." This is a reasonable expectation, but will take considerable effort to achieve this volume of export quality fruit. However, one only needs to look to Ecuador to find that the production per hectare of small farmers is not normally this high.

Assuming for a moment that this is an attainable goal and that with proper incentives and availability of inputs, one might achieve a ten percent increase in production within two or three years, what will be done with all the bananas?

2000 boxes/ha/yr. on 1000 hectares is 2,000,000 boxes/yr. This is over 38,000 boxes per week, every week. Certain amounts of new hectares are planned by the associations. Whatever the amount, it aggravates any already formidable marketing task.

Until someone is certain that the bananas that exist and those that will be produced in the near future can be sold, it is foolishness to have a goal of increased acreage. The previous projects in the region have done an excellent job of assisting the farmers in developing production.

The goal now should not be to increase marketable tonnage, but rather to sell the tonnage that exists. It is not the tonnage that matters, it is the income gained from that tonnage.

If the farmers find that the market needs greater supplies it is certain that they will respond, they will not need the efforts of any project to convince them.

Much effort will have to be expended to achieve export quality on the 1000 or so hectares. Additionally, inputs will be needed. Farmers will make those inputs when they have income from exportation.

The two objectives that should be considered as crucial to development in the Chapare are: 1) Uniform, reliable quality production throughout the region and, 2) delivery of the production to the markets.

It is not how many bananas are produced - it is how bananas are sold.

SECTION III

RECOMMENDATIONS FOR PROJECT ACTIVITIES

Banana production in the Chapare has progressed very well since it became a focal point of alternative development in the early 1990's and has done extremely well in surviving the crisis of black sigatoka.

From a beginning of a few farmers in rustic conditions barely able to produce sufficient volumes of bananas for a weekly truckload, production in the Chapare has now arrived at a stage of development of an infant industry.

The quality of production seen on farms throughout the region demonstrates that the potential exists to compete in quality with bananas in any market. Many farms lack the quantity of quality production required to participate in the export market this can be improved. Some farmers will never have the ability to participate, but those willing to make the effort can, with assistance, achieve economic benefits from banana production in both the domestic and export markets.

I ask the reader to bear with me for a moment and imagine that he or she has been sent to Bolivia by a major banana marketer, Chiquita, Dole, Del Monte, or whomever. Your responsibility is to ensure that the company can call you at any time and you will have the required volume of bananas of consistent quality ready when needed.

The company will give you the support necessary to assist the growers, you have to develop a cost effective way to provide the necessary assistance.

With that idea in mind and to the point of what kind of assistance is needed, the following suggestions are offered:

PROJECT OBJECTIVE: Develop uniform quality production throughout the Chapare region.

PURPOSE: All farmers should be able to participate equally in the export or domestic market. What this means is that there should be no differentiations among associations or areas that allow potential buyers to play one association off against another and thus control the price paid for bananas. While remaining independent, the associations in the region should recognize that they are part of a larger organization that cannot be exploited. Buyers should be able to contact any association and know they can get:

- a) Quality bananas,
- b) timely production, and
- c) quantities needed, in the
- d) form required.

ACTIVITIES SUGGESTED: Enough knowledge about banana production exists in the region to develop an action program of uniform cultivation practices. The project should coordinate the development and implementation of a training program for members of all the associations.

The program should be one of intensive field training, not one of copying information from existing literature and holding classroom sessions, although this may well be a supplementary part of the program.

To ensure that the training has sustainability, each association should have its own technician to assist the members in properly maintaining their farms and monitor the effectiveness of sigatoka control.

Some associations that were visited have their own technicians. These technicians need to be well trained and occasionally given refresher courses or training on new techniques or problems that arise.

The development of a uniform cultivation program should be under the guidance of the CONCADE Project and include technicians and/or representatives from all the associations. I believe the person most qualified to coordinate and take the lead in the design of this program is Rolando Escobar of IBTA/Chapare. I have met no one with a better understanding of the banana production in the Chapare or anyone with a better working knowledge of banana production operations.

As much as knowing how to manage the cultivation practices on a farm, the farmer must have the ability to physically accomplish the tasks

A farmer, working by himself, does not have the physical ability to manage much more than four hectares of banana production and do it well. The two farm labor practices mentioned earlier are stated here, again, and it is urged that the associations be urged to consider and adopt them, especially as most farmers plan to increase their hectareage and in many cases can barely handle what they have.

In the more common situation, the members of the association form teams among themselves to carry out the various tasks on all the farms such as pruning of daughter plants, bagging of stems, de-leafing, etc. Some of these tasks can be rotated to avoid boredom with tasks. Some such as ground spraying for sigatoka control and pruning of daughter plants may be best performed by those who have the skill to do these tasks well.

The other system is for each member to hire a laborer to be part of a crew that carries out the various tasks on all the farms. Each week a different member is assigned to manage the operations of the crew. This idea seems to work well, but needs to be accompanied by a caveat that the laborers should be well trained and well supervised or the results might be less than desired.

A third option would be if the grower is earning enough from his production he might hire the extra labor needed to adequately manage his farm.

As in any industry there will be some growers who do not want to participate. Every effort should be made to include as many farmers as possible, but the goal should be to have a program that results in uniform optimum quality production throughout the region.

PROJECT OBJECTIVE: Develop an extension program through an ONG to provide technical assistance in the form of a monitoring of the banana operations and a link with the Project, IBTA and other technical assistance groups.

PURPOSE: To monitor the work being done in the associations by the technicians and the grower members and ensure that the production practices are being carried out satisfactorily. This is not to be meant as a program of criticism, but rather one of constructive advice when warranted.

Also the extensionist could assist in trials or experiments and be a link with IBTA/Chapare or other research organizations to ensure that farmers' questions are answered and problems resolved. In addition to providing this service and the necessary follow-up, the extensionists could also assist the associations in dealing with the marketers and others.

This theme or idea was presented to the growers visited during this consultancy and received acceptance. Most of those who said they thought that a training program on production, coupled with their own technician and an extensionist to monitor the operations was a workable idea seemed sincere. The other point that was brought out by some and agreed upon by most farmers was that they not want an extension agent who had less knowledge than they and who seemingly wandered aimlessly about the region.

ACTIVITIES SUGGESTED: Contract an NGO to provide extension agents trained in banana production who participate in the training program of the farmers. Give the extension agents hands-on training so they are completely familiar with production practices.

Assist the NGO in the development of a program for:

- a) monitoring the activities of an association or associations. Include as part of their responsibility, surveys of conditions of farms, levels of sigatoka infection, status and timeliness of production practices, and other similar activities.
- b) Provide for the association, the Project and IBTA/Chapare a standardized report on a regular schedule.
- c) Provide a link with the IBTA/Chapare in the design and implementation of trials and experiments for improved production.
- d) Ensure that production problems are correctly communicated to the entity capable of resolving the problem. Provide follow-up to ensure a resolution is received and implemented.

As a personal footnote to this suggestion I also suggest that this would be a good area in which to employ women. In addition to being as capable as men in the field, the attention to detail which most women give to a task would be very beneficial in this type of work.

PROJECT OBJECTIVE: Conduct a market analysis to determine what current and potential markets volumes and prices exist for:

- a) Which varieties of bananas,
- b) what quality levels,
- c) what types of packs, can be sold at
- d) what price?

PURPOSE: The challenge of the Project is going to be its ability to assist the farmers in the marketing of their bananas. There are many more bananas in the Chapare than are currently being exported and increased volumes are constantly being produced.

One of the original project goals was to increase the tonnage per hectare. Increases can be effected, not to the extent the project document stated, but the critical consideration is how to sell the bananas that are produced.

There are potential markets for different types of packs that may be acceptable to the market. Some of these markets need to be developed, others exist. What needs to be known is what prices can be expected for bananas and what will this mean to the farmer in terms of returns per hectare.

The first step is to determine what markets exist for what types of products and how much can potentially be earned from sales to those markets. Currently there are three companies selling bananas to various regional markets. Judging from the bananas being exported, their marketing abilities are not very sophisticated. There is little more being done than putting bananas and taking them to someone who will buy them.

A good example of the lack of sophistication is what is known in the industry as "single-finger pack" or "institutional pack." This is a pack in which individual fingers are removed from the crowns and the box is packed with 150 or some other specified number of fingers. The pack is designed for sale to schools, hospitals and other institutions that have cafeteria operations. In these institutions it is not the weight or size of the individual fingers that is important, it is the number of fingers per pound. This market niche is important to the banana industry because it allows for sale of fingers that do not meet retail market specifications for size.

The need for a market for short fingers exists among farmers in the Chapare. Packing high grade, long-fingered bananas in a single-finger pack serves no one. Another pack which may have a place in the market(s) is that of "cluster pack." As a word of explanation, retailers know that consumers tend to buy bananas by a certain number of fingers. Bananas are sold by weight and thus the largest possible fingers are required by the retailer. In the cluster pack, clusters with fingers that are too short for the regular pack are put into clear plastic bags with a logo and other information, if desired, and sealed. The consumer has to buy the entire bag, cannot separate the fingers, thus the retailer does not suffer loss of sales.

Another device which may serve to enhance the marketability of the bananas is labeling of the clusters. This practice has been proven to make one supplier's bananas preferable to another's even when there is no difference in quality.

A labeling program should be used in conjunction with a quality assurance program. The boxed banana quality level determined to be adequate for labeling should be strictly adhered to, never compromised or the confidence of consumers may be lost.

A label requires the design and use of a logo. Having a logo with which the farmers, as well as consumers can identify, can serve as a unifying factor with the farmers.

The purpose of knowing what can be sold in the market, what new types of packs can be introduced and labeling of clusters, is to maximize the sale of bananas from the Chapare. Understanding the markets' needs and working with them to improve sales volumes will also develop a rapport with the market to help ensure long-term relationships with them.

What is needed is a serious marketing program, one that can displace others in the regional markets. The quality exists to be able to capture markets, but a higher level of sophistication is required to achieve this goal.

One other point with regard to quality of bananas being sold in the regional markets is that, while it is important to have quality as good or better than the competition, the "better" should not be excessively so. Each higher level of quality has a very high price tag.

Farmers will increase their production based upon the returns realized from sales. Only increased income from sales will allow the farmer to make the inputs necessary for increased production.

ACTIVITIES SUGGESTED: A market study should be conducted by someone experienced in the marketing of bananas in the U.S. This person should be able to not only determine the potential market

size, prices, and requirements for bananas, but also work with major buyers to determine how to introduce packs of bananas not already being marketed.

This information should be shared with banana buyers as an incentive to purchase bananas from small farmer associations.. The other activities, designed to achieve and maintain a high level of quality, suggested in this report are made to help buyers become marketers and respond to the markets' needs.

PROJECT ACTIVITY: Establish and implement a Quality Assurance Program throughout the region to ensure that all farmers know and can meet quality standards required for export.

PURPOSE: The purpose of a quality assurance program is to establish quality standards and enable farmers to achieve and maintain a constant level of quality of the packed fruit.

Quality in bananas is set down in quality specifications or standards that are objectively measured and quantitatively defined. A box of bananas that meets 90% of standards in one market is classified exactly the same in any other market. Different quality levels may be demanded by different markets, but the standards and their measurement do not change.

Specifications or standards exist for bananas and those of other exporters can be used, modified only as the markets require. For example, the finger length of Chiquita and other brands going into U.S. and European markets is 8" over the curve. For bananas to carry the logo of the major brands they must meet this standard or be considered defective. This specification could most likely be reduced to 7.5" for the Chilean and Argentinean markets.

The market study proposed would largely determine what modifications are necessary to the specifications attached to this report as addenda.

Quality standards serve various purposes, they are:

- They provide an objective measure of quality when a dispute arises.
- They provide a common language for communication between the market and the grower and/or shipper.
- They enable marketers to accurately measure their quality against the competition.
- They provide a basis for measurement when quality incentives are offered.
- They provide quantitative feedback to the producer on levels of defects.

Quality control inspections conducted at the time of packing provide immediate feedback to the packing shed management that can be used to correct problems that are occurring.

Data collected from the inspections is very useful over time in quantifying defects and their seasonal times of occurrence. Percentages of defects found in boxed fruit can be monitored to determine to what extent the problems are being controlled.

The percentages of defects found also allow a determination to be made on the feasibility of efforts to reduce the incidence of the defect. For example, if one percent of the fruit is defective due to bruising, eliminating or reducing the problem may not be economically feasible. If the incidence of bruising is five percent, the dollar loss of this amount may pay for better equipment and the effort needed to ensure that handling practices are improved.

With quality problems, as with any problems, if the problem is well defined the resolution to the problem is found in the definition. Quality control is an indispensable tool in maintaining quality and providing information for improvement of yields.

Another area of quality assurance less recognized, but of equal importance is the analysis of the fruit that is not packed. This analysis complements the inspection results of the boxed fruit. Knowing the defects that are causing the loss of fruit and the amounts being lost serve the same purpose as the results of boxed fruit in terms of being able to put a monetary value against the losses.

Another quality assurance inspection that should be carried out, when possible, is an inspection at the destination of the fruit. There are defects of bananas that appear or worsen after a period of time in the box and others that are caused by handling or transit conditions.

Some of the problems or defects of the bananas at destination can be a result of poorly managed procedures in the packing shed. Over-packing can result in bruising, poor application of Benlate and/or alum can cause problems with crown rot or latex staining. Correct, quantitative information from the market of destination can help resolve these problems.

Other problems, such as ripe and turning bananas at destination may be the result of problems on the farm and/or problems of the unit transporting the bananas. Some problems, such as chilling injury may be caused by the unit transporting the bananas.

If a market share is to be gained and maintained at a profit to the grower and shipper, there must be a reliable program of quality assurance to support each process in the production/marketing system.

ACTIVITIES SUGGESTED: The introduction and implementation of a quality assurance program is only possible when bananas are actually being packed for export. For this reason the implementation can only proceed at the rate of participation of the associations.

However, the basis of the program can be developed now. Attached are copies of quality assurance programs that contain specifications, methodology, forms and instructions for the responsibilities of the personnel involved in the fruit cutting and packing operations. One manual is in Spanish and is the program introduced and implemented with the largest exporter of bananas from Ecuador. The other is an English version roughly similar.

The specifications in both are the specifications for shipments to the U.S. and Europe. These will need to be modified according to information derived from the market study. All measurements are in the English system and will have to be converted to the metric system.

Some companies may say that they have quality assurance or control programs and most do have copies of this same information on quality specifications. Quality assurance programs do not exist and only a few of the specifications are used. Amounts and types of quality defects are mostly ignored or not understood.

In order for a quality assurance program to be effective, everyone in the system must know and understand the program and its components. This requires a training program.

To implement a quality assurance program, there must be trained inspectors, a program to monitor the results of the quality inspections and a mechanism for feedback of information to solve quality problems. This requires trained inspection teams that are properly equipped.

At the start of the project, until such time as export of bananas of the small farmers' associations are being exported, the extensionists of the field monitoring operations suggested above can also do quality inspections.

Once export reaches the volume that requires too much of the extensionists' time as inspectors, new extensionists can be phased in for field or quality assurance positions. Eventually, these two areas of work should independent of each other.

There is an obvious conflict of interest when a person responsible for production is also involved in quality control. The Project must also decide to whom the quality inspection teams will be responsible. It should never be someone in production or sales/marketing.

Private companies prefer to do their own quality assurance or control. This is their prerogative, since they are producing or buying the fruit and selling it. However, when the bananas of an association or grower who comes under the Project are being packed, the quality assurance program can still proceed although the rejection of any fruit may not be possible. The information gained from inspections is of great value.

Without a quality assurance program there is little possibility of maximizing production while gaining and maintaining a strong market presence.

Two people who I would strongly suggest be contacted to help implement a quality assurance program and a complementary postharvest handling program are:

Sr. Felix Bates of La Lima Honduras - Don Felix was in charge of quality control for the Tela Railroad company for many years and is now retired. In all my years in quality assurance I have never met anyone as skilled as he at introducing a quality assurance program and training people in its function and management. If Sr. Bates is not available he will probably be able to recommend someone since, for lack of bananas in Honduras, the quality program was drastically reduced.

Sr. Rosalino Gomez of La Lima, Honduras - Rosalino was George Wilson's assistant in research for several years and continued to work in postharvest research with the various postharvest specialists who followed George. Having participated in the studies and experiments conducted to develop the technology of postharvest handling of bananas gives Rosalino a far better understanding of postharvest than most classroom educated experts. I believe that Rosalino is available to work as a consultant.

I can obtain the telephone numbers of both of these gentlemen if needed.

One additional note. This is another area in which women can be employed. If it were my company, I would prefer to have women managing the quality assurance program.

PROJECT OBJECTIVE: Determine which of the FHIA cultivars of bananas and plantains are suitable for the needs of the Chapare and ensure that the correct material is obtained.

PURPOSE: The plots where FHIA cultivars are being experimentally grown contain off-types. It is not certain if these off-types are mutations or mistakes. A large amount of planting material has been brought into the Chapare from sources that, in hindsight, have been questionable.

There are too many experts who think they know the FHIA cultivars and their characteristics and potential. There are cultivars that have potential. Some varieties have shown this potential, others have not and some have not been tested.

ACTIVITY SUGGESTED: Contract Dr. Phillip Rowe of FHIA to come to the Chapare see the conditions and discuss results obtained to date. Based on his observations and other information available he can suggest a program for development of cultivars presently produced, recommend other cultivars, and assist in the design of a production program. He can also recommend a program to obtain planting or propagation material directly from FHIA.

SECTION IV

SOME SUGGESTIONS OF LESSER PRIORITY

While visiting the production and packing operations in the Chapare, some observations were made on activities that need to be corrected, investigated or implemented.

- 1) The plastic slipsheets or polytubes being used in the boxes of bananas are out of specs and need to be corrected to reduce costs and better serve their purpose. Cartons also appear to be less than adequate. I have a copy of all the specifications for packing materials that I will send to Dr. George Wilson.
- 2) There may a good potential for plantains in local and export markets. The market and the production of the new FHIA varieties should be investigated to determine this potential.
- 3) Alum is used in banana packing to prevent the oxidation of the latex from cut crowns and the staining of the fingers caused by it. In the process of producing medicinal quality alum, metal (iron, I believe) settles out of the compound. In poorer forms of alum the metal is present and the alum is ineffective. A simple test should be conducted occasionally to test the quality of the alum.

This is done by allowing a fairly large amount of alum to collect on a white plastic sheet and treat it with a spray of the recommended alum solution. If the latex turns brown as it dries, the latex is defective.

- 4) Only Benlate is being used to control crown rot. As with any fungicide program, it is important to alternate fungicides to avoid resistance to the fungicide being developed. Mertect is a fungicide recommended for crown rot control that can be alternated with Benlate. Mertect is available in Bolivia and should be used.

Another product, Imazalil, is also used when a better control of crown rot is needed. It is not known if this product is available in Bolivia.

Well sharpened banana knives and proper crown trimming techniques continue to be the major factor in crown rot control.

- 5) The most common suggestion from both small farmers and the commercial producers in the Chapare was that a pathologist is needed to be able to respond to the problems found in the field. I put this in this category of lesser priority, but it deserves more attention than that. It is part of the suggestions for the role of IBTA/Chapare.

Attention to their pathological/physiological problems and a quick response on how to resolve the problem is critical to a successful banana production program.

- 6) Currently, there is one suggested application of nitrogen and potassium fertilizers for the bananas in the Chapare. Obviously, not all areas or farms have the same requirements.

Soil analyses have been and are conducted. Since soil analyses do not indicate if or how much of the available nutrients the plants can take up, a program of leaf tissue analysis should be implemented in conjunction with the soil analyses.

7) As mentioned earlier, some fruit is being packed with a minimum finger length of 8" and other at 7.5." It may or may not be determined that the market does not need 8" fingers, but for those packing 7.5" fingers, trials should be conducted to determine if removal of the removal of two hands when bagging a large stem of bananas is cost effective.

8) The Project should determine if there is anything that can be done to provide technical assistance to the chiperos. The chipero with whom we spoke in San Luis expressed a need for information on storage and ripening. These buyers are an important part of the production/marketing system and should be provided some technical assistance, if necessary.

9) A committee should be formed composed of farmers, Project personnel, buyers, IBTA technicians and perhaps suppliers of inputs. The purpose of the committee would be to bring all members of the banana industry in the Chapare together to discuss matters of importance to them. This does not need to be a formal, decision-making body, its purpose would be to ensure that the ideas and problems of everyone have a forum for discussion. Too many small problems and some large ones have fallen between the cracks over the years and one hears about problems long after they could have been resolved.

10) If the bananas and other horticultural products are to arrive at their potential for improving the economy of the region, the highway system must be improved. While this is not in the realm of the Project, it is worthwhile for the Project to keep reminding people that others are willing to make an effort, but need support in the form of good roads.

SECTION V
IBTA/CHAPARE
ACCOMPLISHMENTS
AND
FUTURE ROLE

In 1992 the principal contribution of IBTA/Chapare to the cooperative effort to develop banana production in the region was its efforts to bring in tissue culture plants of the Williams and Gran Nain cultivars, plant, harden and distribute the plants to growers.

This effort and continuation of the program made possible the current production in the Chapare. Additionally, technicians of IBTA, experienced in the region and knowledgeable of the farmers, assisted the PDAR and OAP projects establish the first banana organizations in the region.

There was an attitude that developed and that still persists today that the extensionists of IBTA were poorly organized and controlled and, in general, contributed little assistance to the farmers of the region. This is true, although it does a disservice to several extensionists who were conscientious and made contributions to the development of banana production.

During this visit the diminished presence of IBTA was obvious, but the contributions that have been made and are still made are very noticeable.

Demonstration plots have been established so farmers have the opportunity to see how cultivation practices are carried out and can see the results on a farm in their own area.

Previously IBTA had a very nice botanical garden, but little information ever left the research station. The demonstration plots illustrate what is a change in attitude to a more practical approach to technical assistance.

Introduction of, and research plots dedicated to the production and study of FHIA cultivars is another area of research that is directed toward improvement of regional banana production. This work is also done off the station, handled by local growers and monitored by IBTA personnel.

Research efforts such as these can only be effectively made by IBTA personnel.

In 1991 through 1998, various cultural studies were initiated on bananas by IBTA/Chapare. A report was published on the objectives and the results. Those objectives and results are copied here and comments are made based either on observations or opinion.

Research Objective	Principal Results	Comments
1994 - Optimize protocol for micro-propagation of bananas.	1994 - The best methods of micro-propagation were found.	IBTA has a capability of 150,000 plants per year by two systems of propagation.
1998 - Evaluate forecasting system for sigatoka in Cavendish bananas.	1998 - The program allows for a reduction in spray cycles from 32 to 24 with a 30% reduction in cost.	The forecasting has given good results, but cycles will depend on the raininess of the various regions.
1994 - Planting densities in Williams and Gran Nain.	1996 - Plant density was increased from the 625 pl/ha in traditional varieties to 1584 pl/ha with Gran Nain and Williams. Production increased 150%.	Plant populations are irregular and in general, to light. This currently recognized by IBTA and the density will be increased when possible.
1994 - Effect of corm size on growth and yields of Gran Nain.	1996 - Corms of 1,000 to 1,500 grams gave an increase of 15% in yield over corms of 250 - 500 grams.	The percentage of yield is probably correct, the corm size is definitely the minimum planted in Central America.
1994 - Comparison of yields and other agronomic characteristics of cultivars.	1996 - Differences do not exist among Gran Nain, Williams, Guayaquil and Valery. Significant differences exist between these and the traditional varieties.	This did not really require a test. It is surprising that Guayaquil (Valery) yields as well as Gran Nain. The yield should be greater for Gran Nain than for any of the others, if only because it produces well at higher densities.
1994 - Study of nematodes in Chapare bananas.	no date - The nematodes affecting bananas include Radopholus at a population of 673/100 grams of root. The population highest in October and lowest in June.	Other nematode were found, but are not significant. Nematodes do not seem to be a major problem. Study should continue.
1991 - Validation of three technologies for export banana production.	1992 - With only cultural practices of weed control, de-leafing, de-handing and bagging of the stem the fruit quality improved 60%.	There is an obvious improvement made by use of these practices and they have been adopted by farmers.
1993 - Response of Gran Nain to nitrogen and potassium fertilizer in two regions of the Chapare.	1996 - Levels of 200 kg of N and 400 kg of K had the best return, 184% over capital with a yield of 2210 boxes per hectare.	Fertilizer trials should continue in conjunction with leaf analysis. Farmers are aware of the benefits of these results.

1998 - Introduction of FHIA 01 and FHIA 18	on-going - These cultivars are being tested as alternatives for farmers whose resources do not permit control of sigatoka.	Resistance results look good. Market trials and other quality trials need to complement this study.
1998 - Tests of chemicals for control of black sigatoka. (Tests of doses recommended on labels.)	on-going Tested and found effective, Tilt, Bumper, Champion, Taspas, Assist and Duett. Assist and Champion were the lowest cost for control, Tilt and Taspas were the most expensive.	Given the high cost of these fungicide and the number of cycles necessary, this is a very important study.
1997 - Research on sigatoka control with participation of farmers.	1998 - With the participation of 300 farmers, the number of spray cycles and necessary equipment was determined for each zone. Basically the tests showed the viability of the Cavendish varieties in the region.	The results of this research is noticeable throughout the region. Farmers are able to control the sigatoka and the Cavendish varieties are producing well.

IBTA/Chapare needs to play an on-going role in banana research. There is still much to be learned about the cultural practices needed to optimize production. Field trials are the only valid way to accomplish this. It appears that the attitude of IBTA/Chapare toward research has become more oriented toward improving yields and reducing costs to farmers. They are to be congratulated for what they have accomplished.

They have not done so well in responding to problems that farmers have in the field. When a farmer has a problem that he does not understand or is concerned that he might have a disease he must have someone he can depend upon for a fast, reliable response. He feels his livelihood is threatened and wants help or assurance that what he perceives to be a problem is not.

It is claimed by several farmers that IBTA extensionists have come to the farms and taken samples for analysis and have never been heard from again.

IBTA should have a good pathologist and a plant physiologist to serve the needs of farmers in all of the Project crops. Within reason, they should be given the laboratory equipment needed to perform analyses. For those analyses that are beyond their capability or for which laboratory does not exist at La Jota, there should be a reliable laboratory(s) to which samples can be sent for analysis.

During most of my time in the field I was with Rolando Escobar. Meeting with farmers and seeing the results of the work done over the past nine years makes me appreciate very much the work done by Rolando. I have met very few technicians anywhere who have the range of knowledge and understanding the Rolando has. This knowledge coupled with his ability to work with the farmers makes him an invaluable asset to banana production in the Chapare. In a world of would-be experts, Rolando has proven himself to be the best. He should be the person who makes the final decision on what will be done to increase banana production and quality.

Another very impressive IBTA technician is Guinter Marcos of IBTA/MIP. This man is skilled and dynamic. In the area of training and molding young people to be I think Guinter would be exceptional. He is also capable of using his talents and enthusiasm equally well in a number of crops.

IBTA/Chapare has become a practical, goal oriented organization compared with what they were in previous years. For banana production to be successful, the farmers must have support and continued development of new techniques and varieties. IBTA/Chapare is a serious organization that, with assistance, can fill this need.